

# XP2i Operation Manual

for XP2i-DP Digital Test Gauge



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# Overview

## INTRODUCTION

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**Thank you for choosing the XP2i-DP Digital Test Gauge from Crystal Engineering Corporation.** The XP2i-DP is a combination of leading edge technology, double-sided isolated differential pressure sensing, and rugged industrial design.

Based on the XP2i Series platform, the –DP has all the key features of the product line with additional capabilities that include:

- 0.1% of reading accuracy wet/wet differential transducer
- Excellent performance in long term high vacuum applications

## OPERATING INSTRUCTIONS

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The XP2i-DP operates just like all the XP2i Series products. The uniqueness of the differential pressure capability comes from the integration of the differential sensor and process fitting system. The keypad and remote functions are the same as on all XP2i Series products. For further details about these common features, refer to the [XP2i Operation Manual](#) (P/N 4870).

# Specifications

## Differential Pressure Accuracy

20 to 100% of Full Scale . . . . .  $\pm$  (0.1% of Reading + Static Line Effect).

0 to 20% of Full Scale . . . . .  $\pm$  (0.02% of Full Scale + Static Line Effect).

Static Line Effect: 0.0003 psi/psi of lowest static pressure.

Includes all effects of linearity, hysteresis, repeatability, temperature, and stability for one year.

## Temperature

Operating . . . . . -10 to 50° C (14 to 122° F).

Non-condensing. No change in accuracy over operating temperature range. Gauge must be zeroed to achieve rated specification.

Storage . . . . . -40 to 75° C (-40 to 167° F).

Battery should be removed if stored for more than one month.

## Media Compatibility

Liquids and gases compatible with 300 Series stainless steel and buna-n (o-ring).

## Pressure Conversions

1 psi = 27.6806 inches of water column (water at 4° C [39.2° F])  
 27.7070 inches of water column (water at 15.6° C [60° F])  
 27.7292 inches of water column (water at 20° C [68° F])  
 2.03602 inches of mercury (mercury at 0° C [32° F])  
 51.7149 millimeters of mercury (mercury at 0° C [32° F])  
 703.087 millimeters of water column (water at 4° C [39.2° F])  
 0.070307 kilograms per square centimeter  
 68.948 millibar  
 6.8948 kilopascals  
 0.068948 bar  
 0.006895 megapascals

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## Connections

Pressure Connections . . . . . 1/8" Female NPT (both + and – ports).

Communication . . . . . DB9, RS-232 (environmentally sealed).

**Note:** Do not use the RS-232 connector in a hazardous atmosphere.

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## Display

Screen . . . . . 5.5 digits.

Display Rate . . . . . 4 readings/second (standard).  
8 readings/second (PSV mode).

Numerical Display Height . . . . . 16.9 mm (0.67") single line display. LCD readable in sunlight with bright backlight.

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## Enclosure

(U.S. Patent D612277)

Weight . . . . . 915g (2.0 lbs), including batteries.

Dimensions . . . . . 165.1 mm (6.5") H x 112 mm (4.4") W x 33 mm (1.3") D.

Rating . . . . . IP67.

Housing . . . . . Diecast, nickel plating over low copper, marine grade aluminum.

Keypad and Labels . . . . . UV Resistant Polyester.

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## Sensor

Permanent fill dual diaphragm seal (filled with Dow Corning 200).

Max Static Line Pressure . . . . . 100 psi.

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## POWER

Batteries . . . . . Three size AA (LR6) batteries.

**! WARNING:** Do not remove or change the batteries in hazardous locations.

## Approved Batteries

The XP2i-DP is Intrinsically Safe only if powered by one of the following battery types:

Approved Battery Type	Ta=	Marking
Rayovac Max Plus 815	-20 to 50° C	Ex ia IIC T4 Ga
Energizer E91*		
Energizer EN91*	-20 to 50° C	Ex ia IIC T3 Ga
Duracell MN1500		

Replace batteries with approved type in non-hazardous locations only

\* Energizer is manufactured by Energizer Holdings, Inc., and the Eveready Battery Company, Inc.

Many other battery types and models have been tested but failed to meet the requirements for Intrinsic Safety—do not assume other models are equivalent. The XP2i-DP can be operated from an external power supply (P/N 2984).

Do not mix battery types or manufacturers.

► **CSA: The XP2i is Intrinsically Safe only if powered by one of the following battery types:**

Approved Battery Type	Ta=	Marking
Rayovac Max Plus 815	-20 to 45° C	Class I, Division 1, A, B, C, D T4
Energizer E91	-20 to 50° C	Class I, Division 1, A, B, C, D T3C
Energizer EN91		
Rayovac Max Plus 815		


! **WARNING:** Use of Duracell MN1500 batteries is not approved for CSA certification.

! **WARNING:** Do not use the AC Adapter kit in hazardous locations.


Battery Life ..... 1500 hours typical (alkaline battery).

Ultra Low Power ..... > 1 year, typical with 20 minute recording interval in LT5 mode.

Battery Indicator ..... 3-segment Battery Icon:

(  ): Full Battery

(  ): Used Battery

(  ): Low Battery

Dead Battery Indication ..... *batt*

## PRESSURE RANGES, DISPLAY SCALES, AND RESOLUTION

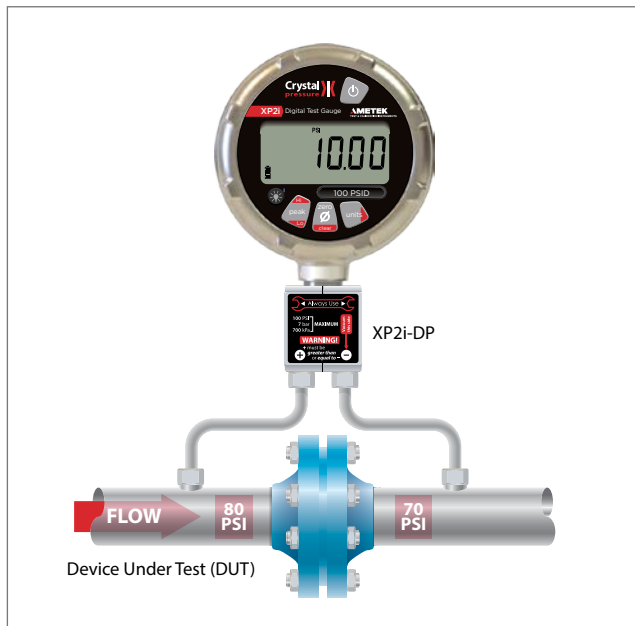
psi	bar	kPa	MPa	Overpressure (+/- ports)	psi	inH <sub>2</sub> O	inHg	mmHg	mmH <sub>2</sub> O	kg/cm <sup>2</sup>	bar	mbar	kPa	MPa
15PSI	1BAR	100KPA	0.1MPA	6.5 x / 3.0 x	0.001	0.01	0.001	0.01	1	0.0001	0.0001	0.1	0.01	0.00001
100PSI	7BAR	700KPA	0.7MPA	2.0 x / 2.0 x	0.01	0.1	0.01	0.1	1	0.0001	0.0001	0.1	0.01	0.00001

- Unneeded pressure units may be disabled via the RS-232 connector using ConfigXP software.
- An XP2i-DP will indicate pressure up to 10% above its stated pressure rating. Above 110%, the XP2i-DP display will flash, indicating that the applied pressure exceeds the calibrated pressure range. If the calibrated pressure range is exceeded, the pressure displayed may not be accurate.
- Overpressure is the maximum pressure the gauge can withstand without damage. The gauge will not indicate pressure up to this value.
- kPa and MPa models can display pressure in kPa, MPa, and bar (and/or mbar) only. psi and bar models can display all available units.

# Applications

## DIFFERENTIAL PRESSURE

The XP2i-DP may be used to determine accurate differential pressure measurements across a range of applications or installations such as filters, orifice plates, valves, etc. For example, in a piping system with an upstream static pressure of approximately 80 psig, the XP2i-DP may be used to determine the 10 psid pressure drop across the device under test (DUT). In this case, the product would be connected as shown below.



The pressure measurement accuracy of the gauge in this example is a combination of the standard accuracy statement and the static line pressure effect. The 10 psid pressure, when compared to the 100 psi full scale product used, will require the 0 to 20% of Full Scale,  $\pm(0.02\%$  of Full Scale) accuracy statement. The static line pressure effect relates to the lowest test pressure applied in the test, or in this case 70 psi.

The pressure measurement accuracy for this test condition is as follows:

$$\pm(0.02\% \times 100 \text{ psi}) + (0.0003 \text{ psi} \times 70 \text{ psi}) = \pm 0.04 \text{ psi.}$$

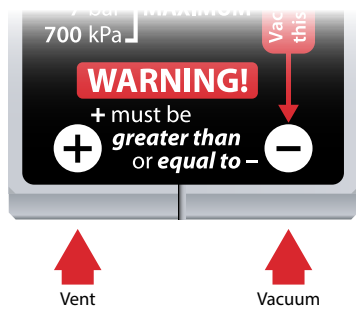
When using a 15 psi full scale gauge, this will require the 20 to 100% of Full Scale,  $\pm(0.1\%$  of Reading) accuracy statement.

$$\pm(0.1\% \times 10 \text{ psi}) + (0.0003 \text{ psi} \times 70 \text{ psi}) = \pm 0.031 \text{ psi.}$$

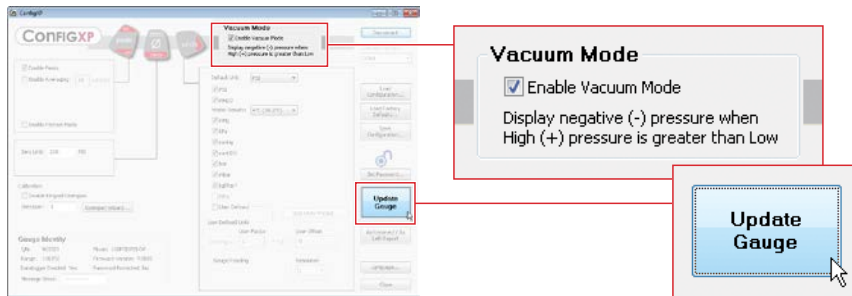


## CONTINUOUS VACUUM

The unique design of the differential pressure sensor integrated into the XP2i-DP allows for long term vacuum use without fear of permanent damage to the sensing chip or package. When measuring high vacuum gauge pressures continuously it is recommended to connect the static line pressure to the right (-) port marked "Vacuum this side". To achieve gauge measurements, the left (+) port is left vented to atmospheric pressure.



**Note:** When connected in this orientation, the XP2i-DP display will invert the sign on the gauge display. For example, a pressure of -12 psi on the negative port will display +12 psi. To invert the sign to read -12 psi, use ConfigXP Software (V 2.4 or later).



Select Enable Vacuum Mode and update the gauge to properly display a negative pressure value.

**! WARNING:** Pressure applied to the + sensor port must be greater than or equal to the pressure applied to the - sensor port.

The vacuum accuracy of the gauge will be calculated the same as a differential measurement. Therefore, the 12 psi measurement, when compared to a 100 psi full scale gauge used, will require the 0 to 20% of Full Scale,  $\pm 0.02\%$  of Full Scale accuracy statement.

The vacuum accuracy for this test condition is as follows:

$$\pm (0.02\% \times 100 \text{ psi}) = \pm 0.02 \text{ psi.}$$

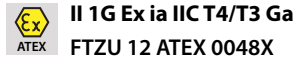
When using a 15 psi full scale gauge, this will require the 20 to 100% of Full Scale,  $\pm (0.1\%$  of Reading) accuracy statement.

$$\pm (0.1\% \times 12 \text{ psi}) = \pm 0.012 \text{ psi.}$$

# Safety & Certifications

## HAZARDOUS LOCATIONS

Every XP2i-DP pressure gauge includes the following Intrinsic Safety approvals:



**II 1G Ex ia IIC T4/T3 Ga**  
**FTZU 12 ATEX 0048X**



Intrinsically Safe and Non-incendive for Hazardous Locations: Class I, Division 1, Groups A, B, C and D, Temperature Code T4 or T3C.

This product conforms to the following standards:

EN 60079-0: 2009 | EN 60079-11: 2012 | EN 60079-26: 2007



**Ex ia IIC T4/T3 Ga**  
**IECEX FTZU 12.0009X**

This product conforms to the following standards:

IEC 60079-0: 2011 | IEC 60079-11: 2011-06 | IEC 60079-26: 2006

**! WARNINGS:** The following warnings apply to the XP2i:

- Do not use the RS-232 connector in hazardous locations.
- Replace batteries in non-hazardous locations and with approved types only.
- Do not mix battery types or manufacturers.
- T4 or T3 Temperature Class is based on selection of approved battery. See [Approved Batteries on page 4](#).
- **Special conditions for safe use:**
  - The equipment shall not be installed in a location where external conditions are conducive to the buildup of electrostatic charge.
  - Because the enclosure of the XP2i and XP2i-DD is made of aluminium, if it is mounted in an area where the use of category 1 G apparatus is required, it must be installed such that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

## CERTIFICATIONS

The XP2i-DP has been tested and certified to comply with a variety of international standards.



This XP2i-DP complies with the Australian requirements for the C-tick mark.  
 The instrument was tested against AS/NZS 3584, C-tick EMC/EMI requirements.



Crystal Engineering declares that the XP2i-DP is in accordance with the ATEX Directive, the Electromagnetic Compatibility Directive, and the Pressure Equipment Directive per our declaration(s).



This XP2i-DP is approved for use as a portable test instrument for Marine use and complies with Det Norsjke Veritas' Rules for Classification of Ships, High Speed & Light Craft, and Offshore Standards.

# Support

## SOFTWARE

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### ConfigXP Configuration Software

Use [ConfigXP](#) to disable unwanted pressure units, set default pressure units, change water density, adjust calibration, and more via the RS-232 interface.

### DataLoggerXP Software

[DataLoggerXP](#) is an optional upgrade to transform the XP2i-DP into a pressure datalogging device.

## REPLACEMENT PARTS

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The only user-replaceable parts are the batteries.

## OPTIONS

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### Panel Mounting (Option F4)

A panel mount flange allows an XP2i-DP to fit in a 4½" gauge cutout. An XP2i-DP with the F4 option can also be adapted to 6 or 8½" gauge cutouts.

### Rear Port Fitting (Option RP)

The rear port fitting may be ordered separately, but is included automatically with the panel mount flange option (F4).

## ACCESSORIES

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### **P/N 2984 AC Adapter Kit**

Permits operation of an XP2i-DP from an AC supply of 90 - 264 VAC and 47 - 63 Hz. Includes interchangeable international plugs (for USA, Europe, U.K., and Australia). Adapter will not charge batteries, but in the event of AC power loss, XP2is will automatically revert to battery operation.

**! WARNING: Do not use the AC Adapter Kit in hazardous locations.**

### **P/N 3696 Protective Boot**

Skydrol™ resistant protective boot.

**! WARNING: Do not use the Protective Boot in hazardous locations.**

### **P/N 2955 6" Gauge Adapter Kit**

Adapts the 4½" Panel Mount (F4 option) to fit into a 6" gauge cutout.

### **P/N 2956 8½" Gauge Adapter Kit**

Adapts the 4½" Panel Mount (F4 option) to fit into an 8½" gauge cutout.

### **P/N 3313 USB-RS232 Adapter**

USB B receptacle to RS232 DB9M.

**! WARNING: Do not use the USB-RS232 Adapter in hazardous locations.**

### **P/N 2400 RS232 Cable**

DB-9 male to DB-9 female straight pass-through cable.

**! WARNING: Do not use the RS232 Cable in hazardous locations.**

## CONTACT US

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**Web** .....[crystalengineering.net](http://crystalengineering.net)

## FACTORY SERVICE

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Please complete the [Return Material Authorization \(RMA\) form](#) on our website. This will generate an authorization number and provide return instructions.

## TRADEMARKS

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This manual contains the following third-party trademarks, both registered and unregistered. All marks are the property of their respective companies.

Rayovac® and Maximum Plus™ .....Rayovac Corporation

Duracell® .....Duracell Inc. Corporation

Energizer® and Eveready .....Eveready Battery Company, Inc.

“Pressure is Our Business” is a registered trademark of Crystal Engineering Corp.

## WARRANTY

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Crystal Engineering Corporation warrants the XP2i-DP Digital Test Gauge to be free from defects in material and workmanship under normal use and service for one (1) year from date of purchase to the original purchaser. It does not apply to batteries or when the product has been misused, altered or damaged by accident or abnormal conditions of operation.

Crystal Engineering will, at our option, repair or replace the defective device free of charge and the device will be returned, transportation prepaid. However, if we determine the failure was caused by misuse, alteration, accident or abnormal condition of operation, you will be billed for the repair.

CRYSTAL ENGINEERING CORPORATION MAKES NO WARRANTY OTHER THAN THE LIMITED WARRANTY STATED ABOVE. ALL WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, ARE LIMITED TO A PERIOD OF ONE (1) YEAR FROM THE DATE OF PURCHASE. CRYSTAL ENGINEERING SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT OR OTHERWISE.

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